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Revision 2
October 11, 2002

System Design Criteria for the OU 7-10 Glovebox Excavator Method Project

General Structures and Site Design Criteria

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Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Idaho National Engineering and Environmental Laboratory
Environmental Restoration Program
Idaho Falls, Idaho 83415

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Assistant Secretary for Environmental Management
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for the OU 7-10 Glovebox Excavator Method Project

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Approved by

Scott A. Jensen, Bechtel BWXT Idaho, LLC
OU 7-10 Glovebox Excavator Method Project
General Structures and Site Design Lead

10/02/02
Date

Brent R. Helm, Bechtel BWXT Idaho, LLC
OU 7-10 Glovebox Excavator Method Project
Design Lead

10/03/02
Date

Steven A. Davies, Bechtel BWXT Idaho, LLC
OU 7-10 Glovebox Excavator Method Project
Project Engineer

10/08/02
Date

CONTENTS

ACRONYMS

AISC	American Institute of Steel Construction
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CDR	conceptual design report
D&D&D	deactivation, decontamination, and decommissioning
DBE	design-basis earthquake
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
ERDA	U.S. Department of Commerce Energy Research and Development Administration
FFA/CO	Federal Facility Agreement and Consent Order
FFS	Facility Floor Structure
IBC	*International Building Code*
INEEL	Idaho National Engineering and Environmental Laboratory
NFPA	National Fire Protection Association
OU	operable unit
PC	performance category
PDSA	preliminary documented safety analysis
PGS	Packaging Glovebox System
RCS	Retrieval Confinement Structure
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SDC	system design criteria
SSC	system, structure, or component
TFR	technical and functional requirements
TRU	transuranic

WAG	Waste Area Group
WBS	Work Breakdown Structure
WES	Weather Enclosure Structure

System Design Criteria
for the OU 7-10 Glovebox Excavator Method Project

General Structures and Site Design Criteria

1. INTRODUCTION

This system design criteria (SDC) document establishes the general design criteria for the general structures and site design for the OU 7-10 Glovebox Excavator Method Project. It is intended to augment the parent document (i.e., *OU 7-10 Glovebox Excavator Method Technical and Functional Requirements* [INEEL 2002a]) sufficiently to enable performance of the glovebox excavator method detailed design, engineering, and evaluation activities.

The 1993 *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory, Idaho Falls, Idaho* (DOE-ID 1993) specifies the environmental remediation of transuranic (TRU) waste from OU 7-10 (which comprises Pit 9) of Waste Area Group (WAG) 7. On October 1, 2001, the Idaho National Engineering and Environmental Laboratory (INEEL) published the *WAG 7 Analysis of OU 7-10 Stage II Modifications Report* (INEEL 2001), which identified a feasible approach for retrieving waste from OU 7-10. This project was established to accomplish the objectives presented in that report. The overall objectives for the project are as follows:

- Demonstrate waste zone material retrieval
- Provide information on any contaminants of concern present in the underburden
- Characterize waste zone material for safe and compliant storage
- Package and store waste onsite, pending decision on final disposition.

This project was requested by the U.S. Department of Energy Idaho Operations Office (DOE-ID) in support of the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (FFA/CO) (DOE-ID 1991), OU 7-10 Record of Decision (DOE-ID 1991), *Explanation of Significant Differences for the Pit 9 Interim Action Record of Decision at the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1998), and Appendix A of the *Remedial Design/Remedial Action Scope of Work and Remedial Design Work Plan: Operable Unit OU 7-10 (Pit 9 Project Interim Action)* (LMITCO 1997).

1.1 Facility Description

The INEEL is a U.S. Department of Energy (DOE) facility, located 52 km (32 mi) west of Idaho Falls, Idaho, and occupies 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Idaho Snake River Plain. The Radioactive Waste Management Complex (RWMC) is located in the southwestern portion of the INEEL. The Subsurface Disposal Area (SDA) is a 39-ha (97-acre) area located in the RWMC. Waste Area Group 7 is the designation recognized by Comprehensive Environmental Response,

Compensation and Liability Act (42 USC § 9601 et seq.) and in the FFA/CO for the RWMC, which comprises the SDA buried waste site. Waste Area Group 7 has been divided into 13 OUs[a]. Operable Unit 7-10 is located in the northeast corner of the SDA. The OU 7-10 site is an area into which chemicals, radioactive materials, and sludge from DOE weapons plants and other government programs were disposed. While such disposal at the RWMC began in 1952, OU 7-10 was used and filled in the late 1960s. The pit contains characteristic hazardous, listed hazardous, low-level radioactive, and TRU waste.

The project facilities and processes are being designed to safely conduct a waste zone material retrieval demonstration in a selected area of OU 7-10. The project processes consist of excavation and retrieval; sampling, packaging, and interim storage; shutdown; deactivation, decontamination, and decommissioning (D&D&D); and environmental monitoring. Project facilities include a Weather Enclosure Structure (WES), Retrieval Confinement Structure (RCS), excavator, ventilation system, and other supporting equipment. The packaged material will be stored onsite, pending decision on final disposition.

1.2 Limitations of the System Design Criteria

This SDC document defines the criteria for the general site design aspects of the project. The SDC flow directly from the Technical and Functional Requirements (TFRs) document (INEEL 2002a) and are intended to include detail not provided in the TFRs, client requirements, and those codes, standards, and regulations that will be used as a basis for the design of the general site. Design criteria will be revised as the project proceeds.

This SDC document focuses only on the general structures and site design criteria. The SDCs for process, excavation, packaging, fire protection, facility and infrastructure, and instrumentation and control are addressed in separate documents.

1.3 Ownership of the System Design Criteria

This SDC document is the product of the combined activities of the OU 7-10 project team. The project engineer has the ultimate responsibility for the content and approval of this document.

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a. Operable Units 13 and 14 were combined in the 1995 comprehensive remedial investigation and feasibility (Huntley and Burns 1995).

2. OVERVIEW

2.1 Facility Structure, System, and Component Functions

General structures and site design addresses a WES and RCS over the excavation site, roads, ramps and parking areas for construction access, an improved gravel area for interim waste storage and segregation, storm water drainage, and other supporting structure, system, or component (SSC) functions.

2.2 Facility Structure, System, and Component Classification

No safety-class SSCs are associated with this project.

The *Preliminary Documented Safety Analysis for the Operable Unit 7-10 Glovebox Excavator Method* (INEEL 2002b) describes the facility safety basis and identifies its safety- significant design features. It prescribes minimum design criteria and functional requirements for the project to follow. A summary of safety-significant SSCs specific to the general structures and site system is below:

- **Retrieval Confinement Structure:** The entire structure of the RCS is considered safety significant, as it provides confinement. This includes the floor structure, the exhaust HEPA filters, and duct work up to the HEPA filters. Included as part of this is the RCS/excavator interface plates and seals.

- **Facility Floor Structure (FFS):** The entire FFS is considered safety significant

- **Weather Enclosure Structure:** The entire structure of the WES is considered low safety consequence

- **Exhaust stack and foundation**: The exhaust stack and foundation is considered low safety consequence.

Additional information regarding critical attributes of these structures is located in Appendix A.

2.3 Operational Overview

This project includes systems to support retrieval and packaging of waste zone materials. The site where the facilities will be located has 6-in. diameter probes that were installed to refusal during Stage I of the OU 7-10 Staged Interim Action Project. These probes may be moved and placed in another area in the pit as necessary during waste zone material retrieval to facilitate retrieval operations. Overburden will be excavated and packaged in soil sacks before disturbing waste zone material.

A manned excavator will retrieve waste zone material. The operator will be located in the WES outside the RCS. The excavator arm, contained within the RCS, will excavate an angular swath. The retrieved material in the excavator bucket will then be placed into a transfer cart. One transfer cart will be located at the entrance of each of the three material packaging gloveboxes. The carts transport waste zone material inside the gloveboxes where it will be inspected, sampled, and packaged.Packaged waste will then be assayed to determine total fissile mass. The waste will then be stored onsite, pending decision on final disposition.

After waste zone material excavation is complete and samples of the underburden are taken, the pit will be backfilled for closure before the D&D&D phase.

3. DESIGN CRITERIA AND BASES

This section contains general civil engineering design criteria applicable to site work, structures, and structural components of the project. The major structures are the WES, the RCS, the FFS, and the waste storage area. Other minor structures are required to support operations. Design criteria include criteria for normal operating conditions, as well as for accident conditions, and safety-significant items are identified. Applicable regulatory and contractual requirements and industry codes and standards are identified for the general structures and site design, when available.

3.1 General Operation Design Criteria

Structures shall be designed to comply with applicable portions of the DOE-ID "Architectural Engineering Standards" (DOE-ID 2001). The general building code of structures in this facility will be the *International Building Code* (IBC) (IBC-2000).

3.1.1 Operational Design Criteria

1. The WES shall provide protection from the weather.

   Basis: *WAG 7 Analysis of OU 7-10 Stage II Modifications*, October 1, 2001, Section 4.3.1, Modification Description. TFR Section 3.1.1.1-1.

2. SSCs designated as safety significant SSCs or that perform emergency functions to preserve the health and safety of workers shall be designed to Performance Category-2 criteria.

   Basis: The Preliminary Documented Safety Analysis (PDSA) (INEEL 2002b) assumes that the WES is designed for PC-2 wind loads and that the RCS and PGS are designed for PC-2 seismic loads. DOE orders, executive orders, and applicable codes require occupied areas to be designed for earthquake loads. The project is required to design for the local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

3. Loading and load combinations for structures shall comply with the IBC Chapter 16 Structural Design.

   Basis: DOE-ID "Architectural Engineering Standards" Section 0111, Structural Design. TFR Section 3.2.5-1.

4. The design ground snow load shall be 35 lb/ft^2.

   Basis: DOE-ID "Architectural Engineering Standards" Section 0111, Structural Design. TFR Section 3.2.5-1.

5. The design wind speed shall be a 3-second gust speed of 90 mph.

   Basis: DOE-ID "Architectural Engineering Standards" Section 0111, Structural Design. TFR Section 3.2.5-1.

6. Flood protection shall be provided by the existing RWMC dikes and drainage system.

Basis: The intent of using existing infrastructure is to be cost effective by minimizing new construction, recognizing that additional infrastructure services may be required if the process and equipment are used for follow-on implementation at a later date. TFR Section 3.1.3-2.

7. Structures potentially exposed to contamination shall be designed to facilitate decontamination and dismantlement of the facility.

   Basis: Work Package Plan for OU 7-10 Glovebox Excavator Method Project – Safe Shutdown and D&D&D work breakdown structure (WBS) C.1.01.07.04.04.05 includes the assumption that D&D&D will occur as part of the project in FY 2005. DOE G 435.1-1, Crosswalk Tables DOE Order 5820.2A vs. DOE O 435.1/M 435.1-1. TFR Sections 3.5.6-4 and 3.5.6-5.

8. The performance category for specific structural and site components will be specified by engineering analysis.

   Basis: DOE-STD-1021-93, "Natural Phenomena Hazards Performance Categorization Guidelines for Systems, Structures, and Components." The PDSA assumes that the WES is designed for PC-2 wind loads and that the RCS and PGS are designed for PC-2 seismic loads. DOE orders, executive orders, and applicable codes require occupied areas to be designed for earthquake loads. The project is required to design for the local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

9. Components of the general structures and site system that may be exposed to radioactive or hazardous waste zone materials shall be compatible with such materials.

   Basis: To ensure reliability of the general structures and site system. Reactions with hazardous or radioactive waste material may cause corrosion and general deterioration. Information regarding compatibility with radioactive and hazardous waste can be located in EDF-2041 and EDF-ER-211.

10. Confinement boundary materials that may be exposed to radioactive contamination shall be stainless steel when practical and not cost prohibitive. Examples are the shoring box skin, RCS panel membrane material, and floor surface materials within the RCS.

    Basis: PLN-343, *OU 7-10 Glovebox Excavator Method Project Facility Shutdown Plan and D&D&D Pre-Plan*. Work package plan for the OU 7-10 Glovebox Excavator Method Project – Safe Shutdown and D&D&D, WBS C.1.01.07.04.04.05, includes the assumption that D&D&D will occur as part of the project in FY 2005. DOE G 435.1-1, "Crosswalk Tables DOE Order 5820.2A vs. DOE O 435.1/M 435.1-1." TFR Sections 3.5.6-4 and 3.5.6-5.

3.1.2 General Structures and Site Accident Design Criteria

This section contains accident design criteria for general structures.

1. Earthquake loads for PC-2 SSCs shall conform to the following criteria:

- Short period acceleration, Ss - 0.357 g
- 1-second acceleration, S1- 0.131 g
- Site class - C
- Seismic importance factor:
  - Ie - 1.5 for structures
  - Ip -1.5 for components
- Seismic use group - III.

Basis: DOE-ID "Architectural Engineering Standards," Section 0111, for PC-2 Structure and IBC, Chapter 16. TFR Section 3.2.5-1.

2. Earthquake loads for low-safety-consequence SSCs shall conform to the following criteria:

- Short period acceleration, Ss - 0.357 g's
- 1-second acceleration, S1- 0.131 g's
- Site class - C
- Seismic importance factor, Ie - 1.0
- Seismic use group – I.

Basis: DOE-ID "Architectural Engineering Standards" for PC-1 Structure and IBC Chapter 16. TFR Section 3.2.5-1.

3. Materials used as components in the confinement system boundary will be noncombustible or fire resistive to the maximum extent possible.

Basis: DOE Order 420.1, "Facility Safety," and National Fire Protection Association (NFPA) 801-1998, "Standard for Fire Protection for Facilities Handling Radioactive Materials." The design must consider the operational aspects of the facility and their associated fire hazards and incorporate proper controls through sound design practices to minimize the potential for fire occurrences. *Preliminary Fire Hazards Analysis for the OU7-10 Glovebox Excavator Method Project* (Gosswiller 2001). TFR Section 3.3.7-1.

3.1.3 Safety-Significant Items

Safety-significant SSCs for general structures and site design requiring PC-2 design rigor include the RCS (including its engineered platform) and the RCS/excavator interface plates and seals. Additional information is available in Appendix A.

3.1.4 Applicable Regulatory and Contractual Requirements

The following laws, regulations, or contractual requirements are applicable to all facilities, structures, and systems unless noted otherwise in specific criteria:

- 29 CFR 1910, "Occupational Safety and Health Regulations" (2002)
- 29 CFR 1926, "Safety and Health Regulations for Construction" (2002)
- DOE O 420.1, "Facility Safety" (November 2000)
- DOE-ID "Architectural Engineering Standards" (2001)
- DOE-STD-1020-2002, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities" (2002).

3.1.5 Applicable Industry Codes and Standards

The following codes and standards are applicable to all structures and systems unless noted otherwise in specific criteria:

- *International Building Code* (2000)
- NFPA 101, "Life Safety Code" (2000)
- *AISC Specification for Structural Steel Buildings -- Allowable Stress Design and Plastic Design* (1998)
- AISC *LRFD Specification for Structural Steel Buildings* (1993)
- American Society of Civil Engineers (ASCE) 7-98, *Minimum Design Loads for Buildings and Other Structures* (1998).

3.2 Facility Floor Structure

The FFS forms part of the confinement system and is the primary structural support for the RCS, PGS structures and components, and the WES. In addition, it provides support for the excavator, the shoring box, most of the ventilation system components, and other systems and components located within the WES.

3.2.1 Operational Design Criteria

1. The FFS shall support the weight of the confinement structures, excavator, and other equipment located within the WES.

   Basis: *OU 7-10 Glovebox Excavator Method Project Conceptual Design Report for Critical Decision 1* (CDR) (INEEL 2001) Section 3.4.1 and IBC Section 1606, Dead Loads. TFR Section 3.2.5-1.

2. The design uniform load shall be 100 psf.

   Basis: IBC Section 1607, Live Loads. TFR Section 3.2.5-1.

3. The design concentrated load shall be a 1,000-lb drum.

   Basis: Approximate weight of 55-gal drum filled with concrete at 147 lb/CF. This is the maximum load that the excavator will be capable of lifting and moving. TFR Section 3.3.1-3.

4. The design wheel load shall be assumed to be 3,200-lb cushion tire.

   Basis: Forklift with a 1,000-lb load.

5. FFS shall be designed to support a stationary excavator load based on the excavator weight of 20,000 lb, wheelbase of 7-ft 4-in., front wheel tread gauge of 6-ft 6-in., and a rear wheel tread gauge of 5 ft 11in.

   Basis: Manufacturer's specifications for the selected backhoe, Caterpillar Model 446B.

6. The load from the excavator shall be determined by excavator analysis.

   Basis: Documentation of the analysis is captured in EDF-2170, "Backhoe Anchorage Structure for the OU 7-10 Glovebox Excavator Method Project."

7. The normal design differential pressure load within the confinement area shall be 1 in. water gauge.

   Basis: ERDA 76-21, *Nuclear Air Cleaning Handbook*, October 1979. Additionally, this is the minimum pressure that the gloveboxes can operate and still have gloves operable. TFR Sections 3.2.7-1, 3.2.7-2, and 3.2.7-3.

8. Wind loading shall be defined by the IBC and as imposed by the WES.

   Basis: The CDR Section 3.4 and IBC requirements for PC-2 building. The PDSA assumes that the WES is designed for PC-2 wind loads. TFR Section 3.2.5-1.

9. Design shall include provisions for temperature changes based on a maximum expected temperature difference of 60°F.

   Basis: Temperatures in the facility must not fall below a point at which the equipment will not be able to operate. All equipment will operate satisfactorily if the comfort zone temperature required by Section 1550 of the DOE-ID "Architectural Engineering Standards" is met. TFR Section 3.2.6-4.

10. The FFS shall comply with commonly accepted fabrication and erection tolerances.

    Basis: DOE-ID "Architectural Engineering Standards" Section 0100, "General Design Requirements," and AISC "Code of Standard Practice for Steel Buildings and Bridges."

11. The FFS floor surface in normally occupied areas shall have a skid resistant surface.

Basis: The project industrial hygienist and safety engineer will perform regular assessments of the work area during operations to ensure compliance with 29 CFR 1910. TFR Section 3.2.4-1.

12. FFS materials that may come in contact with waste shall be compatible with the radioactive and hazardous waste found in the pit.

Basis: To ensure reliability of the FFS. Refer to EDF-ER-211 and EDF-2041.

13. FFS materials that may come in contact with waste shall be selected based on criteria that consider cost, ability to seal joints, resistance to loading, decontamination, and final disposal.

Basis: PLN-343, *OU 7-10 Glovebox Excavator Method Project Facility Shutdown Plan and D&D&D Pre-Plan*. The seals must be designed to maintain confinement. Additionally, the FFS must be designed to facilitate D&D&D. TFR Sections 3.1.1.1-2 and 3.5.6-5.

14. The FFS floor surface within the RCS will have welded seams.

Basis: PLN-343, *OU 7-10 Glovebox Excavator Method Project Facility Shutdown Plan and D&D&D Pre-Plan*. The seals must be designed to maintain confinement. Additionally, the FFS must be designed to facilitate D&D&D. TFR Sections 3.1.1.1-2 and 3.5.6-5.

15. The FFS shall include a shoring box to facilitate excavation of the pit.

The shoring box serves to support the top portion of the excavation in the overburden layer of the arc-shaped excavation area. It reduces the potential for sloughing of the overburden into the waste zone. TFR Section 3.2.5-2.

16. The shoring box shall extend 3.5 ft into the existing overburden.

Basis: The shoring box serves to support the top portion of the excavation in the overburden layer of the arc-shaped excavation area. It reduces the potential for sloughing of the overburden into the waste zone. The thickness of the overburden is 3.5 ft. TFR Section 3.2.5-2.

17. The shoring box shall be designed for at-rest soil pressures for the applicable installation depth.

Basis: The shoring box serves to support the top portion of the excavation in the overburden layer of the arc-shaped excavation area. It reduces the potential for sloughing of the overburden into the waste zone. TFR Section 3.2.5-2.

18. The shoring box shall enclose a fan-shaped area defined by a 145-degree arc and a 20-ft radius.

Basis: The project must excavate a volume between 75 and 125 yd^3. The dimensions of the shoring box supports the excavation volume and the constraints imposed by excavator geometry. TFR Sections 3.1.1.1-4 and 3.2.5-2.

19. The FFS shall include a guardrail or other fall restraint system around the excavation area to facilitate personnel entry to the RCS during the time when the excavation is open.

Basis: The project industrial hygienist and safety engineer will perform regular assessment of the work area to ensure compliance with 29 CFR 1910 and 29 CFR 1926. Fall protection is required by 29 CFR 1926, Subpart M, "Fall Protection." TFR Section 3.2.4-1.

3.2.2 Accident Design Criteria

In addition to the accident design criteria identified for general structures, the following accident design criteria are specific to the FFS:

1. The maximum design differential pressure load within the confinement area shall be 4 inches water gauge.

   Basis: ERDA 76-21, *Nuclear Air Cleaning Handbook*, October 1979. Additionally, this is the minimum pressure at which the PGS gloveboxes will be tested for leakage.

2. The FFS support shall be designed to support a 24-ft diameter circle subsidence failure of the ground surface due to sloughing of the excavation, or localized subsidence of the OU 7-10 surface.

   Basis: The project must resist subsidence and angle of repose. TFR Section 3.2.5-2.

3.2.3 Safety-Significant Items

The portions of the FFS that are safety significant and require appropriate design rigor are those areas supporting the PGS and the RCS, and the area within the RCS. The FFS shall be designed to PC-2 criteria for WES wind loading. Additional information on critical attributes is available in Appendix A.

3.3 Retrieval Confinement Structure

The RCS is part of the confinement system and is the enclosure for the excavation area.

3.3.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to the RCS:

1. The RCS shall support its own weight and the weight of supporting systems attached to it, such as lights, fire suppression systems, conduit, and ventilation system components.

   Basis: CDR Section 3.4.2 and IBC Section 1606, "Dead Loads."

2. The RCS ceiling design shall include the loads that may be imposed on it during construction and D&D&D. These are defined as:

   a. The greater of a design uniform live load for framing of 20 psf or the design operating pressure

   b. A design concentrated live load of 250 lb.

   c. The ceiling design shall also include provision for fall restraint.

Basis: IBC Section 1607, "Live Loads," Section 1607. Fall restraint is required by 29 CFR 1910. TFR Sections 3.5.6-4 and 3.5.6-5.

3. The normal design differential pressure load shall be 1-in. water gauge.

Basis: ERDA 76-21, *Nuclear Air Cleaning Handbook*, October 1979. Additionally, this is the minimum pressure that gloveboxes can operate and still have gloves operable. TFR Sections 3.2.7-1, 3.2.7-2, and 3.2.7-3.

4. RCS materials that may come in contact with waste shall be compatible with the radioactive and hazardous waste found in the pit.

Basis: To ensure the reliability of the RCS. Reactions with hazardous and radioactive waste materials may cause deterioration of the seal boot, potentially causing a breach of confinement. Information regarding compatibility with the radioactive and hazardous waste can be located in EDF-ER-211 and EDF-2041.

5. RCS materials that may come in contact with waste shall consider cost, ability to seal the confinement boundary, resistance to loading, decontamination, and final disposal.

Basis: CDR Appendix B, "Data Quality Objectives." PLN-343, *OU 7-10 Glovebox Excavator Method Project Facility Shutdown Plan and D&D&D Pre-Plan.* The seals must be designed to maintain confinement. Additionally, the RCS must be designed to facilitate D&D&D. TFR Sections 3.1.1.1-2 and 3.5.6-5.

6. The RCS materials that may be exposed to radioactive contamination shall be stainless steel when practical. An example is the RCS panel membrane material.

Basis: To facilitate ease of D&D&D. PLN-343, *OU 7-10 Glovebox Excavator Method Project Facility Shutdown Plan and D&D&D Pre-Plan*. Stainless steel is an acceptable material per EDF-ER-211 and EDF-2041. TFR Section 3.5.6-5.

7. The RCS panels shall be sealed by caulking and taping.

Basis: The panel seams must be designed to maintain confinement. Caulk and tape must be selected per EDF-ER-211 and EDF-2041. TFR Section 3.1.1.1-2.

8. The RCS design will include gloveports to accommodate remote coupling of excavator end effectors.

Basis: Reduce the entries and time personnel are in the confinement area. Per TFR 3.2.6-1, the project will be operated by workers located outside confinement during waste zone material retrieval. Supports as low as reasonably achievable goals. TFR Sections 3.2.2-1, 3.2.2-2, 3.2.2-3, and 3.2.6-1.

3.3.2 Accident Design Criteria

In addition to the accident design criteria identified for general structures, the following accident design criteria are specific to the RCS:

1. The maximum design differential pressure load shall be 4 iwg.

Basis: ERDA 76-21, *Nuclear Air Cleaning Handbook*, October 1979. Additionally, this is the minimum pressure at which the PGS gloveboxes will be tested.

2. The RCS shall be designed to limit the possibility of inadvertent penetration by the excavator.

   Basis: Per PLN-1024, *Risk Management Plan for the OU 7-10 Glovebox Excavator Method Project*, Appendix C, the risk associated with penetration of the RCS by the excavator is a moderate risk. The Risk Management Plan recommends implementing "Stop Work" and deadman controls to mitigate the risk.

3. The RCS shall be capable of passive confinement of radionuclides during and after a loss of ventilation event.

   Basis: Per the PDSA, Section 2.6.2.4, "The ventilation system is designed and constructed so that active systems are not required to achieve and maintain the facility in a safe shutdown condition. A passive shutdown strategy is an integral part of system design. The passive shutdown design ensures that in the scenario of complete failure of all systems, or a complete loss of power, the ventilation system will revert to a condition in which no unfiltered paths exist." TFR Sections 3.1.1.1-2, 3.2.7-1, and 3.2.7-2.

3.3.3 Safety-Significant Items

The RCS is safety significant because it protects the immediate area worker from exposures above evaluation guidelines and requires appropriate design rigor, in particular the seal system between the excavator and the RCS structure. Additional information is available in Appendix A.

3.4 Waste Storage Area

3.4.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to the waste storage area:

1. The waste storage area shall be located adjacent to OU 7-10.

   Basis: Waste zone material must be stored onsite pending decision on final disposition. Onsite storage of retrieved waste zone materials is required per the 1993 Record of Decision (DOE-ID, 1993). TFR Section 3.1.2.5-4.

2. The waste storage area shall be designed and constructed to facilitate mandatory weekly inspection of waste drums.

   Basis: Inspections are required by 40 CFR 264 Subpart I. Specific storage requirements and design approach are addressed in EDF-3032, *OU 7-10 Glovebox Excavator Method Project Storage Requirements and Approach*. TFR Section 3.1.2.5-4.

3. The waste storage area shall be located at an elevation at or above 5008.9 ft.

   Basis: The waste storage area must be located at or above the 100-year floodplain elevation. 100-year floodplain elevation is documented in EDF-2051, *OU 7-10 Glovebox Excavator Method Project Pit 9 100-Year Water Surface Determination*. Specific storage

requirements and design approach are addressed in EDF-3032, *OU 7-10 Glovebox Excavator Method Project Storage Requirements and Approach*. TFR Section 3.1.2.5-4.

4. The waste storage area shall provide storage space for a minimum of 747 waste containers.

   Basis: EDF-3125, *OU 7-10 Glovebox Excavator Method Project Calculations*, and EDF-2158, *OU 7-10 Glovebox Excavator Method Process Model*, predict that there will be 536 55-gal drums and 44 85-gal drums, for a total of 580 drums of primary waste. Additionally, secondary waste may have to be stored as well, adding an additional 167 drums.

5. Drainage from the waste storage area shall be directed toward the existing RWMC drainage.

   Basis: Per the TFR, the project is required to use existing utilities, where available. The intent of using existing utilities is to be cost effective by minimizing new construction, recognizing that additional utility services may be required if the processes and equipment are used for follow-on implementation at a later date. TFR Section 3.1.3.-2.

6. The waste storage area shall be located at least 20 ft from the nearest building.

   Basis: Fire protection requirement identified in an August 14, 2002, e-mail from E. B. Gosswiller to D. E. Wilkins entitled, "Re: Fire Detection and Protection Requirements for up to 17 Waste Hazmat Containment Modules."

7. All vegetation shall be cleared within 30 ft of the waste storage area.

   Basis: As directed by the INEEL, Wildland Fire Management Guide. Fire protection requirement identified in an August 14, 2002, e-mail from E. B. Gosswiller to D. E. Wilkins entitled, "Re: Fire Detection and Protection Requirements for up to 17 Waste Hazmat Containment Modules."

3.4.2 Accident Design Criteria

The following accident design criteria are specific to the waste storage area:

1. The waste storage area shall be designed and constructed to facilitate emergency response actions.

   Basis: The storage area must accommodate emergency response such as fire and spill response.

3.4.3 Safety-Significant Items

No safety-significant items have been identified for the waste storage area.

3.5 Weather Enclosure Structure

The WES is a low safety consequence structure that will comply with applicable DOE-ID "Architectural Engineering Standards" and the IBC.

3.5.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to the WES:

1. The WES shall be designed using the PC-1 criteria at a minimum except for wind loading.

   Basis: The PDSA assumes that the WES is designed for PC-2 wind loads. DOE orders, executive orders, and applicable codes require occupied areas to be designed for earthquake loads. The project is required to design for the local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system.

2. The WES shall be designed to meet PC-2 wind loading criteria.

   Basis: The preliminary safety analysis assumes that the WES is designed for PC-2 wind loads. TFR Section 3.2.5-1.

3.5.2 Accident Design Criteria

In addition to the accident design criteria identified for general structures, the following accident design criteria are specific to the WES:

1. The WES membrane material shall comply with the flame resistance requirements of NFPA 701, "Standard Methods of Fire Tests for Flame Propagation of Textiles and Films."

   Basis: The Fire Hazards Analysis for the OU 7-10 Glovebox Excavator Method Project makes the following recommendation (Recommendation 4-1): "Request test reports to confirm that the Universal Fabric Structure membrane complies with flame resistance requirements of NFPA 701 and that the membrane and insulation meet the requirements of ASTM E 84 for a Class A finish."

2. The WES membrane material and insulation shall comply with the requirements of ASTM E84-01, "Standard Test Method for Surface Burning Characteristics of Building Materials" for a Class A finish.

   Basis: The Fire Hazards Analysis for the OU 7-10 Glovebox Excavator Method Project makes the following recommendation (Recommendation 4-1): "Request test reports to confirm that the Universal Fabric Structure membrane complies with flame resistance requirements of NFPA 701 and that the membrane and insulation meet the requirements of ASTM E 84 for a Class A finish."

3.5.3 Safety-Significant Items

The WES is considered low safety consequence. Additional information can be located in Appendix A.

3.6 Consumer Grade Structures

This section discusses the design criteria for those project commercial grade structures (i.e., structures not considered safety significant or low safety consequences) not addressed elsewhere in this SDC.

3.6.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to consumer grade structures:

1. Design for consumer grade structures shall comply with the DOE-ID "Architectural Engineering Standards."

   Basis: The project must be designed to withstand the effects of INEEL climate and natural phenomena in accordance with the DOE-ID "Architectural Engineering Standards." TFR Section 3.2.5-1.

2. Consumer grade structures shall be designed using a PC-1 criteria as defined in the DOE-ID "Architectural Engineering Standards" Section 0111, "Structural Design."

   Basis: DOE-ID "Architectural Engineering Standards," Section 0111, "Structural Design." DOE orders, executive orders, applicable codes require occupied areas to be designed for earthquake loads. The project is required to design for the local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

3.6.2 Accident Design Criteria

1. If the failure of a consumer grade structure will have little or no impact to the performance of the safety related SSCs, then they need not be designed for natural phenomena (e.g., moveable structures small enough that movement during an earthquake has little safety consequence).

   Basis: DOE-STD-1020-2002, "Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities."

3.6.2 Safety-Significant Items

Not applicable.

3.7 Roads, Site Grading, and Parking

3.7.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to roads, site grading, and parking:

1. Access for construction shall be provided from Madison Avenue on the existing roads. No improvements are required.

   Basis: The design must utilize existing infrastructure available at the RWMC, where possible. The intent of utilizing existing infrastructure is to be cost effective by minimizing new construction, recognizing that additional infrastructure services may be required if the processes and equipment are used for follow-on implementation at a later date. TFR Section 3.1.3-2.

2. Access for the operations shall be provided on existing roads, which come through RWMC located to the south of OU 7-10.

   Basis: The design must use existing infrastructure available at the RWMC, where possible. The intent of utilizing existing infrastructure is to be cost effective by minimizing new construction, recognizing that additional infrastructure services may be required if the processes and equipment are used for follow-on implementation at a later date. TFR Section 3.1.3-2.

3. Pads with structural fill to support facilities and runoff shall be constructed for the WES, the drum assay trailer(s), and the interim storage.

   Basis: Adequate structural support is required for safe and effective performance and use of the WES, the drum assay trailer(s), and the waste storage area.

4. A ramp shall be constructed over the west rail system to facilitate access to the pit for the excavator and transfer of material and personnel throughout operations.

   Basis: CDR Section 3.2.3.

5. Site grading west of the rail system shall be performed to provide safe construction and emergency access and egress to the OU 7-10 facilities. In addition the area will be graded to provide drainage into the existing drain system.

   Basis: The design must utilize existing infrastructure available at the RWMC, where possible. The intent of utilizing existing infrastructure is to be cost effective by minimizing new construction recognizing that additional infrastructure services may be required if the processes and equipment are used for follow-on implementation at a later date. TFR Section 3.1.3-2.

6. A parking area west of the pit shall be constructed for three van type vehicles to transport operational personnel from the main gate to the pit area.

   Basis: CDR Section 3.2.3.

3.7.2 Accident Design Criteria

Not applicable.

3.7.3 Safety-Significant Items

Not applicable.

3.8 Storm Water Control Features

3.8.1 Operational Design Criteria

In addition to the operational design criteria identified for general structures, the following operational design criteria are specific to storm water control features:

1. Storage facilities for this project shall be located above a flood elevation of 5,008.9 ft.

Basis: EDF-3032, *OU 7-10 Glovebox Excavator Method Project Storage Requirements and Approach*, Section 4.2.2, "Floodplain Considerations." The project must comply with the substantive requirements for storage of radioactive wastes, as well as Resource Conservation and Recovery Act (42 USC § 6901 et seq.,) and Toxic Substances Control Act (15 USC § 2601 et seq.). There are a number of ARAR requirements that apply to storage that must be met (i.e., Resource Conservation and Recovery Act, Toxic Substances Control Act, and DOE O 435.1, "Radioactive Waste Management"). The requirements affect the required facility (containment requirements), waste handling (separation of incompatibles), packaging, and emergency equipment. TFR Section 3.1.1.3-2.

2. Site grading west of the rail system shall be designed to accommodate the localized 25-year rainfall event. The 25-year, 6-hour storm is 1.4 in. of water. Localized storm water will be directed away from the WES and allowed to infiltrate into the pit.

   Basis: DOE-ID "Architectural Engineering Standards;" Section 0200, "Civil Design"; Subsection 2.8, "Surface Drainage." The project is required to design for local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

3. Site grading shall direct storm-water away from the OU 7-10 facilities.

   Basis: The project is required to design for local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

3.8.2 Accident Design Criteria

In addition to the accident design criteria identified for general structures, the following accident design criteria are specific to storm-water control features:

1. The existing RWMC dikes and drainage system will be used for additional flood protection.

   Basis: Per TFR Section 3.1.3-2, the design must utilize existing infrastructure available at the RWMC, where possible. The project is required to design for the local effects of storm water. Larger scale flooding will be handled by the existing RWMC flood control and drainage system. TFR Section 3.2.5-1.

3.8.3 Safety-Significant Items

Not applicable.

4. REFERENCES

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Appendix A

Structure Critical Attributes List

Appendix A

Structure Critical Attributes List

A.1. Development of Quality Assurance Requirements for the Weather Enclosure Structure

Table A-1. Weather Enclosure Structure.

Structure, System, and Component	Safety Function	Technical and Functional Requirements Document Requirement	Critical Characteristic	Supporting Technical and Functional Requirements Document	Specification	Method of Verification
WES	Protect RCS and PGS from wind and other weather related effects	3.1.1.1-2. The project shall provide a confinement for radiological and hazardous materials.	Ability to resist the design basis wind loading	3.2.5-1 Resist natural phenomena	ASCE 7-98 wind loading, 90 mph design wind speed, PC-2.	Analysis and design verification (MCP-9217)

Table A-2. Individual components of the Weather Enclosure Structure.

Weather Enclosure Structure Component	Safety Function	Applicable criteria	Critical Characteristics	Supporting Documents	Method of Verification
WES structural framing including structural connections	Resist design loads including design basis wind	PC-2 wind loading	Material strength	Vendor data	Certificate of conformance to ASTM requirements or CMTRs
				Design and analysis report or EDF	Independent peer review
WES skin, doors and windows	Resist design loads including design basis wind	PC-2 wind loading	Material strength	Vendor data	Certificate of conformance
				Design and analysis report or EDF	Independent peer review
WES door and window joints or seams	None	None	NA	NA	NA
WES penetrations	None	None	NA	NA	NA
WES fire protection system	Mitigate design basis fire	PC-1 earthquake loading		Test report	Testing per NFPA requirements
WES painting	None	None applicable	NA	NA	NA
WES H&V system	None	Mounting must resist PC-1 earthquake loading	NA	Design and analysis documents	Design checking
WES lighting	None	Mounting to resist PC-2 earthquake loading	NA	NA	NA

ASTM = American Society for Testing and Materials
CMTR = Certified Material Test Report
EDF = engineering design file
H&V = heating and ventilating
NA = not applicable
NFPA = National Fire Protection Association
PC = performance category
WES = Weather Enclosure Structure

A.2. Development of Quality Assurance Requirements for the Facility Floor Structure

Table A-3. Facility Floor Structure.

Structure, System, and Component	Safety Function	Technical and Functional Requirements Document Requirement	Critical Characteristic	Supporting Technical and Functional Requirements Document	Specification	Method of Verification
FFS	Confinement of radioactive contamination and hazardous materials within the RCS	3.1.1.1-2. The project shall provide a confinement for radiological and hazardous materials.	Low leak rate	Same as general requirement	No leaks per leak test criteria	Leak test
			Ability to resist design loads	Same as general requirement	1 inch of water for normal operation plus other applicable loads	Analysis and design verification (MCP-9217[a])
			Ability to survive DBE	3.2.5-1 Resist natural phenomena	IBC earthquake criteria with I = 1.5, DOE PC-2	Analysis and design verification (MCP-9217[a])
	Safely support RCS, PGS and other components		Ability to resist design loads from the RCS, PGS, and other components	Same as general requirement		Analysis and design verification (MCP-9217[a])
	Span possible subsidence areas and areas of possible sloughing of the excavation		Strength necessary to support loads for the applicable spans			Analysis and design verification (MCP-9217[a])

DBE = design-basis earthquake
DOE = U.S. Department of Energy
FS = Facility Floor Structure
MCP = management control procedure
PC = performance category
PGS = Packaging Glovebox System
RCS = Retrieval Confinement Structure

a. MCP-9217, 2002, "Design Verification," Rev. 1, November 1, 2001.

Table A-4. Individual components of the Facility Floor Structure.

Facility Floor Structure Component	Safety Function	Applicable PC-2 Criteria	Critical Characteristics	Supporting Documents	Method of Verification
FFS structural framing including structural connections	Resist design loads including DBE	PC-2 earthquake loading from RCS and PGS. PC-2 wind loading from the WES.	Material strength	Vendor data	Certificate of conformance to ASTM requirements or CMTRs
				Design and analysis report or EDF	Analysis and design verification including independent peer review
FFS floor plate within the RCS	Resist design pressures and floor loads	Resist earthquake loading from components as applicable.	Material strength	Design and analysis report or EDF	Certificate of conformance to ASTM requirements or CMTRs
					Analysis and design verification
FFS liner plate within the RCS	Confine materials	None	No holes	Test report	Leak test
FFS decking and floor plate outside of RCS	Resist design loads	Okay for deflections from PC-2 wind loading.	Material strength	Vendor data	C of C
				Design and analysis EDF	Analysis and design checking
FFS liner plate seams	Confine materials	None	Welding of seams	Test report	Leak test
FFS floor plate painting	Provide slip resistant walking surface	NA	Slip resistance	NA	Verify that top coat of paint contains grit.

ASTM = American Society for Testing and Materials
CMTR = Certified Material Test Report
DBE = design-basis earthquake
EDF = engineering design file
FFS = Facility Floor Structure
NA = not applicable
NFPA = National Fire Protection Association
PC = performance category
PGS = Packaging Glovebox System
RCS = Retrieval Confinement Structure

A.3. Development of Quality Assurance Requirements for the Retrieval Confinement Structure

Table A-5.Retrieval Confinement Structure.

Structure, System, and Component	Safety Function	Technical and Functional Requirements Document Requirement	Critical Characteristic	Supporting Technical and Functional Requirements Document	Specification	Method of Verification
RCS	Confinement of radioactive contamination and hazardous materials	3.1.1.1-2. The project shall provide a confinement for radiological and hazardous materials.	Low leak rate	Same as general requirement	No leaks per leak test criteria	Leak test
			Ability to resist design loads	Same as general requirement	1 inch of water for normal operation plus other applicable loads	Analysis and design verification (MCP-9217[a])
			Ability to resist design basis accidents	3.3.7 Fire protection	Fire hazard analysis requirements	Analysis, design verification and inspection of the fire protection systems
			Ability to survive DBE	3.2.5-1 Resist natural phenomena	IBC earthquake criteria with I = 1.5, DOE PC-2	Analysis and design verification (MCP-9217[a])

ASTM = American Society for Testing and Materials
CMTR = Certified Material Test Report
DBE = design-basis earthquake
DOE = U.S. Department of Energy
EDF = engineering design file
IBC = Institutional Biosafety Committee
NA = not applicable
NFPA = National Fire Protection Association
PC = performance category
PGS = Packaging Glovebox System
RCS = Retrieval Confinement Structure

a. MCP-9217, 2002, "Design Verification," Rev. 1, November 1, 2001.

Table A-6. Individual components of the Retrieval Confinement Structure.

Retrieval Confinement Structure Component	Safety Function	Applicable PC-2 Criteria	Critical Characteristics	Supporting Documents	Method of Verification
RCS structural framing including structural connections	Resist design loads including DBE	PC-2 earthquake loading	Material strength	Vendor data	Certificate of conformance to ASTM requirements or CMTR
				Design and analysis report or EDF	Independent peer review
RCS skin, doors and windows	Confine materials	Okay for deflections from PC-2 earthquake loading	No holes		Leak test
	Resist design pressures		Material strength	Design and analysis report or EDF	Same as for structural framing
RCS gloveports	Confine materials	Not applicable	No holes, sealing of joints and seams	Test report	Leak test
Excavator boot	Confine materials	Okay for deflections from PC-2 earthquake loading	No holes	Test report	Leak test
	Resist design pressures			Design and analysis EDF	Analysis and design verification
RCS ventilation system	Confine materials	PC-2 for those items that are directly attached to the RCS or close enough to impact it during an earthquake.	No holes or leaks in ductwork or filter housings	Test report	Leak test
			Filter integrity	Test report	Filter acceptance test
			Support resistance earthquake load	Design and analysis EDF	Analysis and design verification
RCS panel, door and window joints or seams	Confine materials	Okay for deflections from PC-2 earthquake loading	Sealing of joints and seams	Test report	Leak test
RCS penetrations	Confine materials	Okay for deflections from PC-2 earthquake loading	Sealing of penetration	Test report	Leak test
RCS fire protection system	Mitigate design basis fire	PC-2 earthquake loading		Test report	Testing per NFPA requirements
RCS painting	None	None applicable	NA	NA	NA
RCS lighting	None	Mounting to resist PC-2 earthquake loading	NA	NA	NA

ASTM = American Society for Testing and Materials
CMTR = Certified Material Test Report
DBE = design-basis earthquake
DOE = U.S. Department of Energy
EDF = engineering design file
NA = not applicable
NFPA = National Fire Protection Association
PC = performance category
RCS = Retrieval Confinement Structure